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1 Scope:

This specification establishes the procedure for LHC D3 combined cold mass assembly. This includes setting up the support posts, installing the lower heat shield, the common support cradles and installing each cold mass onto the common cradles one at a time.

2 Applicable Documents:

The following documents, in effect on the date of issue of this specification, form a part of this specification:

RHIC-MAG-Q-1000	Control of Measurement Test Equipment
RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
LHC-MAG-R-1045	LHC LWR Heat Shield Pressure & Leak Check Proc.
14010508	D3 Combined Cold Mass Assembly

3 Requirements:

3.1 Material/Equipment

Lifting Beam	BNL Dwg. 25-1782.02-5
Insertion Fixture	BNL Dwg. 25-1819.01-5

3.2 Safety Precautions

3.2.1 No welding shall take place unless all welding screens are in place around the welding station, and all personnel not directly involved with the welding process are outside the screens. Any personnel inside the screens shall wear protective gear to prevent eye injury, and shall be clothed to prevent burns caused by intense ultra-violet light.

3.2.2 Operators shall be instructed by their cognizant technical supervisor and qualified in the operation of the required welding equipment.

3.2.3 All lifting and handling operations requiring overhead crane operations shall be performed by holders of valid Safety Awareness Certificates. They shall also be instructed in the use of the appropriate lifting device by the Cognizant Engineer or Technical Supervisor.

- 3.2.4 Operators shall be instructed by their Cognizant Technical Supervisor in the operation of the Insertion Fixture or cold mass setup fixture.
- 3.2.5 Specific steps of this procedure contain electrical and mechanical assembly operations that impact the environment. Prior to performing these steps, personnel shall complete the applicable facility specific environmental training.
- 4 Procedure
- 4.1 Post Height Measurements

NOTE

Be sure to keep end-posts and middle-posts separate as they have different configurations. Middle-post assemblies have P/N LHCQBH_S0003

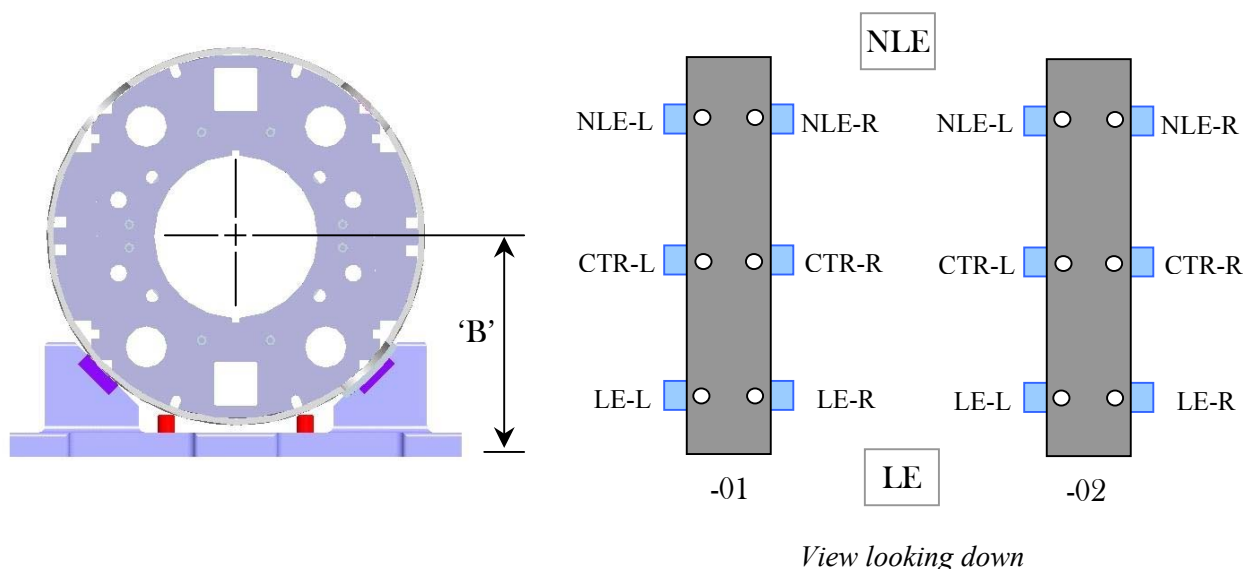
- 4.1.1 Select two end-post assemblies. Identify them with Magnet Number and “lead end” or “non-lead end.” Take height measurements of each post while loaded with **4715 lb** axial compression. Record heights in traveler.
- 4.1.2 Select a middle-post assembly. Identify it with Magnet Number and “center.” Take height measurement while it is loaded with **5975 lb** axial compression. Record height in traveler.

NOTE

The above post height data will be used to determine post shim size during cryostatting.

4.2 Individual Cold Mass Height Calculation for Brass Shim Determination

- 4.2.1 The Cognizant Engineer shall fill out the worksheet in the traveler to determine brass shim size for the purpose of equalizing individual cold mass bore heights. See Figure 0 for layout. Obtain cradle base-to-magnet fiducial measurements from survey data. Select shim sizes to level the cold mass bore heights at all six locations to within .051mm (.002 in.).



Sample Worksheet

Dim	Height B (from survey)	Bearing Strip 14010511	Brass Shims 14010625
-01 LE-L			
etc. ↓			

Figure 0

4.3 Cold Mass Buildup

4.3.1 Place the cold mass insertion sleds on the fixed tray of the insertion fixture.

4.3.2 Position the heat shield blankets over the sleds. Place the outer blanket first, heavy aluminized Mylar facing down (away from shield), splice on the right. Place the inner blanket second, heavy aluminized Mylar facing up (toward shield), splice on the left.

NOTE

Left / Right convention used: Standing at LE looking towards NLE - Top of magnet UP.

4.3.3 Mount the cold mass support posts to the lower heat shield. Install bolts with spacers and bushings and torque to 12 ft-lbs. Posts were marked with magnet number and position when post height measurements were taken during cold mass assembly.

NOTE

Be sure that the support posts are in their correct locations per their markings.

4.3.4 Attach the laminated flexible thermal connections on the posts to the lower heat shield with rivets and weld.

4.3.5 Place the lower heat shield/post assembly on the sleds. Posts fit through the holes in the blankets. Verify lead end of shield is at LE of fixture.

4.3.6 Install the common cradles on the posts. The center common cradle lacks the rectangular slots and, has threaded holes on its sides. Secure each common cradle to the post flange with socket cap screws as indicated. Torque the screws to 12 ft-lbs.

4.3.7 Install brass shims and DU bearing pads on the common cradles (12 places). Secure them with stainless steel flat head screws as indicated. Brass shim sizes were recorded in section 4.2.

NOTE

Left / Right convention used: Standing at LE looking towards NLE - Top of magnet UP.

- 4.3.8 Position the pipe blankets over the posts so that the common cradles protrude through the cut-outs in the blankets. Place the outer blanket first, heavy aluminized Mylar facing down (away from cold mass), splice on the right. Place the middle blanket second, heavy aluminized Mylar facing up (toward cold mass), splice on the left. Place the inner blanket last, heavy aluminized Mylar on both sides, splice on the right.
- 4.3.9 Prepare the D3 cold mass support fixture for lowering the 1st Cold Mass (-01, left-hand) onto the common cradles. Assemble the three support columns so they engage the edges of the common cradles on the same side that the first cold mass will rest. See Figure 0.

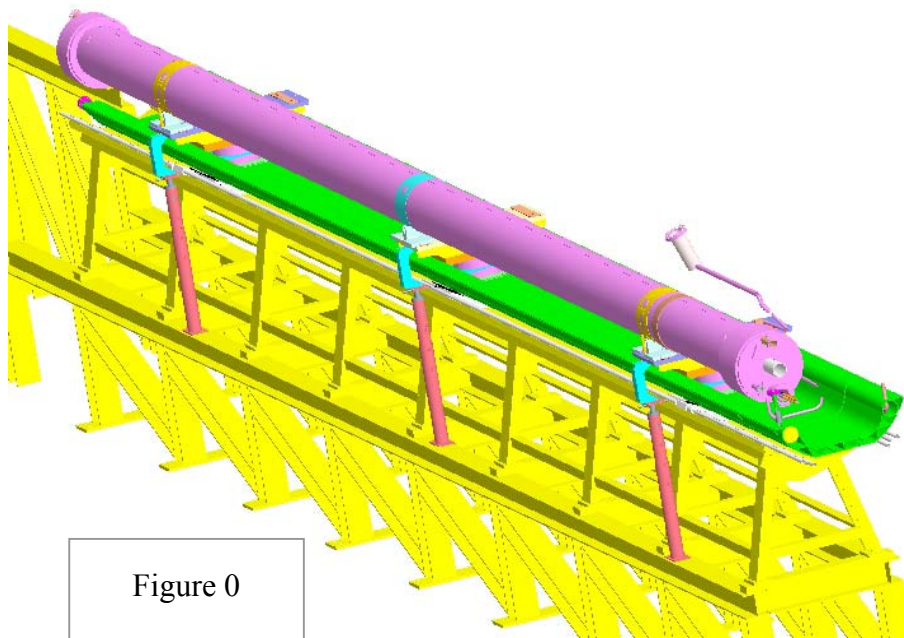
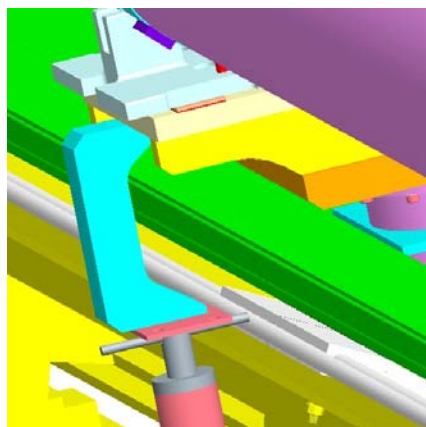
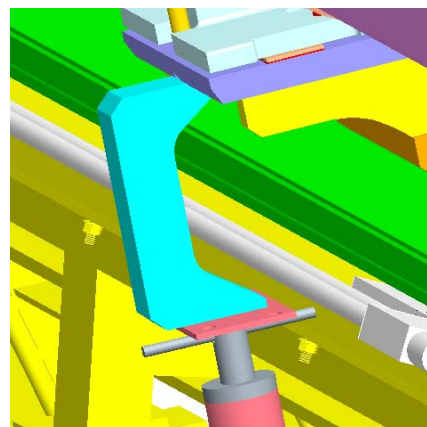


Figure 0



Center Cradle



End Cradles

WARNING

The first cold mass must be installed on the side that is supported by the three tooling columns. Lowering the first magnet onto the other side will result in an unbalanced condition. This may cause the cold mass to topple off of the fixture, causing severe personal injury and /or damage to the cold mass.

NOTE

The 1st cold mass will not have the 7 angled transfer-line supports welded to it.

- 4.3.10 Lay the 1st cold mass blanket, inner surface up, over three support pedestals which are placed at the three cradle locations. Make sure that the pedestals protrude through the cradle cut-outs in the blanket. Place lifting slings around the 1st cold mass. Attach slings to lifting beam. Raise the cold mass up and onto the three pedestals, taking care not to damage the cradle pins. Leave some residual tension in the slings. Wrap the blanket over the slings and around the cold mass. Secure it temporarily with Velcro straps. Make certain that the cradles protrude through the appropriate cut-outs in the blanket. Secure the IFS line.
- 4.3.11 Raise the 1st cold mass. Then lower it onto spacer blocks at the three cradle locations. Thread tooling guide pin onto cradle pin.
- 4.3.12 Install the slide blocks onto each of the two end cradle pins. Align them longitudinally as well as possible.
- 4.3.13 Lift the cold mass and carefully lower it onto the common cradles on the side that is supported by the columns. Make sure that the center pin engages the hole in the center cradle while the slide blocks on the ends mate with the rectangular holes in the end cradles. If the blocks need to be tweaked into position, use a tool to prod them. Do not use one's hands! Verify that the lead end is located at the heat shield's lead end.
- 4.3.14 When the cold mass is in place, detach the slings from the lifting beam. Remove the shackles from the slings. Then carefully pull the slings out from around the magnet.
- 4.3.15 Lay the 2nd cold mass blanket, inner surface up, over three support pedestals which are placed at the three cradle locations. Make sure that the pedestals protrude through the cradle cut-outs in the blanket. Place lifting slings around the 2nd cold mass. Attach slings to lifting beam. Raise the cold mass up and onto the three pedestals, taking care not to damage the cradle pins. Leave some residual tension in the slings. Wrap the blanket over the slings and around the cold mass. Secure it temporarily with Velcro straps. Make certain that the cradles protrude through the appropriate cut-outs in the blanket. Secure the IFS line.”

- 4.3.16 Raise the 2nd cold mass and then lower it onto spacer blocks at the three cradle locations. Thread tooling guide pin onto center cradle pin.
- 4.3.17 Install the slide blocks onto each of the two end cradle pins. Align them longitudinally as well as possible.
- 4.3.18 Lift the second cold mass and carefully lower it onto the common cradles. Make sure that the center pin engages the hole in the center cradle while the slide blocks on the ends mate with the rectangular holes in the end cradles. If the blocks need to be tweaked into position, use a tool to prod them. Do not use one's hands!
- 4.3.19 When the cold mass is in place, detach the slings from the lifting beam. Remove the shackles from the slings. Then carefully pull the slings out from around the magnet.
- 4.3.20 Once both cold masses are in place on the common cradles, remove the middle support column and move it to the opposite side. See Figure 0.

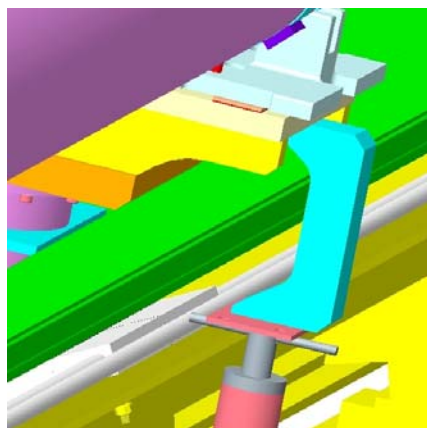


Figure 0

- 4.3.21 Remove the tooling guide pins from the center cradle pins. Secure fixed center cradle pin stud and end cradle sliders with lock washers and nuts as indicated.
- 4.3.22 Install end cradle shipping straps to end common cradles. Secure nuts to tighten straps against cold mass shell (4 places).

NOTE:

These shipping restraint straps must be loosened prior to cold testing to allow for cold mass thermal shrinkage. At that time the straps are left very loose by backing off nuts until they contact the retaining ring.

4.3.23 Install axial restraint bars on each side of center cradle. Torque mounting bolts to 80 ft-lb. Engage jacking bolts against magnet cradles in eight places. Torque jacking bolts gradually and evenly to 20 ft-lbs. Lock into position with locknuts and lockwashers. Torque locknuts to 60 ft-lbs.

4.3.24 Affix the following tag to the main bus leads. "Loosen cradle shipping restraint straps before cold testing".

5 Quality Assurance Provisions:

5.1 The Quality Assurance provisions of this procedure require that the technician shall be responsible for performing all assembly operations in compliance with the procedural instructions contained herein and the recording of the results on the production traveler.

5.2 The technician is responsible for notifying the technical supervisor and/or the cognizant engineer of any discrepancies occurring during the performance of this procedure. All discrepancies shall be identified and reported in accordance with RHIC- MAG-Q-1004.

5.3 Measuring and test equipment used for this procedure shall contain a valid calibration label in accordance with RHIC-MAG-Q-1000.

6 Preparation for Delivery:

N/A